BARRIERS TO THE USE OF DIGITAL INFORMATION BY UNIVERSITY RESEARCHERS

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ABSTRACT

The transition of academic libraries from print to electronic resources is well underway and for most scholars non-engagement with the digital environment has ceased to be an option. The demands placed on the computing skills and understanding of the main features of this environment are considerable, however, and a significant proportion of researchers either fail to take advantage of it or are in fact impeded in their work by their minimal skill sets. We examine the barriers to use of the technology and describe our own experience in training university academics to become more fluent users of electronic information resources. A higher level of engagement by both library and computing staff in training and advocacy is suggested.

1 INTRODUCTION

The rapid pace of technological change in academic information sources and functions over the past twenty years shows no sign of abating and is placing significant demands on the computing skills and understanding of researchers and students alike. Over this period the library profession has been primarily concerned with the promotion of higher order critical skills to students through the information literacy movement, whereas the actual use of modern information resources by professional academics and researchers has not been subject to a similar level of concern. In theory this group has experienced a massive increase in both the amount of material available to them and in their ability to interact with and manage information; in practice many have not made the paradigm shift that would allow them to participate in the benefits of the information revolution.

Despite such innovations within librarianship as faculty liaison, relations between librarians and academic staff are generally not close (Christiansen, Stombler, & Thaxton, 2004); if anything the advent of the “library without walls” has probably tended to increase the distance between the two groups. Left to their own devices many faculty have developed minimalist skill sets that have allowed them to survive in the new environment but that fall well short of the level of mastery that would allow them to thrive. At Massey University we have addressed this issue though a Knowledge Management module in the Training and Development Unit’s Research Management Skills Programme (White, Gendall, & Naidoo, 2004). While we have been pleased with the enthusiastic response to this offering it has also served to highlight the critical nature of the relationship between “computer fluency” and the utilisation of electronic information. This paper will examine further that relationship and will stress the importance of developing computer fluency as an underpinning of academic information competence.

2 DISCUSSION

Here are two typical scenarios from the working lives of academic researchers.

> Researcher A *Sunshine College*
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> She is searching the Web of Science database for articles on the diet of mastodons and mammoths. She finds thirty articles. As some of them are not on the topic and others are not of interest she marks the ones she wants and downloads the records (including abstracts) to an EndNote Library. As there are links from Web of Science to the full text of some of the articles she downloads a number of PDFs and stores them on her computer. Realising that Web of

Science does not index all of the journals likely to contain articles on the subject she then searches Biological Abstracts and finds a further seventy-four articles. She downloads all of these to the same EndNote Library and asks EndNote to detect and delete duplicates. From Biological Abstracts she is able to link to the full-text of some of the articles she was not able to locate through Web of Science and she save the PDFs of these articles as well. Later she goes through and links the PDFs that she saved to the appropriate EndNote records to create a small personal electronic library of research on her subject. She uses the Library's web page to request interloans of those she was not able to download. As there is still an hour before lunch she begins printing and reading the articles. Later when she begins writing her own article in Microsoft Word she is able to insert the EndNote references directly into the document using Cite While You Write.

Researcher B *Grey University*

Researcher B is also searching the Web of Science database for articles on the diet of mastodons and mammoths. She finds thirty articles. Some of them have nothing to do with animals so she feels really puzzled and wonders if she has done the right thing. She marks some of the ones that look okay and when she goes on to the next page of ten results a Marked List button appears at the top of the page. She marks some more records on the second page and then moves to the third page where she marks a further three records before clicking on the Marked List button. The records she marked on the first two pages are there but not the three from the final page. Using the back arrow she returns to this page and notices that she has to "submit" these final three marked records. Returning to the Marked List she now ticks the box marked Abstract to make sure these are included with the records and then from the three options listed she chooses "Export to Reference Software" to download the records directly to her EndNote Library. The "Select a Reference Library" dialog box prompts her to save them in a library called "Untitled" in the Program Files/EndNote folder so she adjusts this to the My Documents/Mastodon folder and saves it in the library she had already created called Mastodon Diet.

In order to see whether any of the articles are available electronically she returns to her search (using about four back arrows) and begins opening individual records. She has to do this as there is no full-text button or library catalogue link on the browsing list. The first one she opens (an article in the Zoological Journal of the Linnean Society) has a "View Full Text" button on the right which opens a new window at the bottom of which she finds (by scrolling down) three choices one of which is "Full Text Article". She ignores this and clicks on the one saying "PDF" instead. This opens a third window containing the PDF file of the article and she clicks on the "File Save" icon. The "Save a Copy" dialog box offers to save a file called "j.1096-3642.2004.00113.x.pdf" on her desktop. She changes the name of the file to "Christiansen – Body Size.pdf" and points to the My Documents/Mastodon folder to save it in. After closing the two windows she has opened she returns to the list and opens another record (for an article from the Journal of Agricultural and Food Chemistry Volume 140 number 4 page 962) which does not have a "View Full Text" button but a "Holdings" button instead. When she clicks on this the Library catalogue opens in another window and she finds that she can click on a link to "View Articles via ACS publications" which she does. The web page for the journal opens in a new window and from a number of choices she clicks on the "back issues" button. Going back to the original window she determines that the article she wants is in volume 140 number 4 and she selects these in the drop down boxes in the journal window and clicks the "go" button. The issue contains about fifty articles but fortunately they are arranged by page number so she can scroll down to page 962 and open the PDF. She clicks on the save icon and saves it in the My Documents/Mastodon folder, renaming it from jf0349883.pdf to "Anotolovich – Phenolic Antioxidants.pdf."

This is probably as painful to read as it is to write so we won't continue but it is worth noting that researcher B has not yet covered even half of the ground so effortlessly traversed by researcher A.

When she comes to Biological Abstracts she will use a whole new set of protocols, similar to those used in Web of Science but not interchangeable with them.

Now is the time to confess that researchers A and B are in fact the same person and that the process carried out in such brain-aching detail in the second scenario is identical to the quick-click romp of the first. Sunshine College, of course, doesn't really exist outside of the glossy brochure, whereas Grey University is a real place – it is in fact the place where we all work. It has been possible to describe most of the steps that allow our researcher to carry out this procedure but to add to that a description of the options available at each point and the practical implications of following each of them would be almost impossible. She knew, for example, that in the absence of a "full-text" button it was necessary to click on the "Holdings" button – this is obvious to those who already know it, less so to new or infrequent users of the database. The point of this is not to deny the power of the electronic information environment but to highlight its complexity and the demands it makes of our skills and understanding. If we look at scenario A, for example, we can identify a number of separate "spaces" that we move through or operate within to carry out the task –

- The IP address of the researcher's computer within the university network which determines the permissions it receives on the Internet.
- The Library web page(s) linking to the database.
- The Web of Science search screen.
- The results list (divided into pages of ten records each).
- The individual records opened from the results list, including links to other cited and related records.
- The Marked records list.
- The information moving from Web of Science to EndNote which must be directed to the correct EndNote Library.
- The folder layout of the researcher's computer (which may include networked folders).
- The EndNote Library which is itself a complex environment consisting of records of different types, document templates, import filters and bibliographic styles.
- The URL of the bibliographic record which allows the researcher to link to it (but only from an appropriate IP address).
- The tripartite protocol between the database (Web of Science), the journal publisher (Blackwell Science) and the University Library that allows the full text button to exist for articles to which the researcher has access.
- The Library catalogue that acts as a link between the database and the journal when such a protocol does not exist.
- The journal web page, with its complex structure of volumes and issues not to mention its other functionalities, including its own search facility and seamless links to other products from the same publisher.
- The article itself, which may exist in both HTML and PDF format and often with links to other documents and products.
- The article as saved on the researcher's computer.

- The Word document which interacts with the EndNote Library to allow use of the cited references.

At any given point in time the researcher can be working in or moving through a number of these spaces each of which will have its own set of rules. The database will time out, for example, if it is left unused for more than a relatively short period, it may host only a finite number of simultaneous users, it may have a number of output functions only one of which will successfully export to a bibliographic manager like EndNote and so on. The likelihood of following a linear and predictable route from the beginning of the database search to the use of the records and documents without recognising the existence of these spaces and understanding their use is effectively non-existent. Even worse is the possibility of following one of the many tempting links leading out from these spaces to other less productive ones.

Wallace Hannum (2002) argued that "we are in a time in which the distinction between scholars who have integrated technology fully into their work and those who have not has become more important than the distinction within the academy between the sciences and the humanities." In a study of the information needs of university professors Maria Anna Jankowska (2004) found that "unawareness of the range of databases, the lack of knowledge about electronic resources among faculty, lack of time, lack of training and instruction were critical obstacles to effective use of electronic resources and services by faculty." Nor are the difficulties confined to the conceptual level – Ann Peterson Bishop (1999) coined the marvellous phrase "insurmountable molehills" to describe the "potentially large effect of a small technical problem" such as difficulties in entry of a network ID number. Various usability studies in the computing literature make similar points (Adams & Blandford, 2002; Blandford, Stelmaszewska, & Bryan-Kinns, 2001; Feng, Jeusfeld, & Hoppenbrouwers, 2001; Theng, Mohd-Nasir, & Thimbleby, 2000).

Writing of IT fluency Herbert Lin (2002) draws a distinction between the navigational options available to residents of a city and to occasional visitors. While the visitor will tend to follow a predetermined path from airport to destination (usually the first one they learnt) a resident will adopt a much more flexible strategy, varying the route according to traffic conditions. Needless to say the resident also has access to a much wider range of destinations within the city, but Lin's main point is that the resident, by understanding both the overall structure of the city and a good deal of ground-level detail, is able to call upon a much wider range of alternatives and understands that the simplest route is not always the fastest or most convenient. Looking at electronically-based research it becomes immediately clear that decisions between alternatives will always have to be made and that a linear map from entry point to destination will never suffice for any but the most basic of explorations. In short, it is necessary for researchers to become residents of the electronic information environment. It is tempting in fact to add to Lin's metaphor a third category – "immigrants", those who inhabit the city with only a limited grasp of its language and culture, living in survival mode and looking nostalgically to a past in which they felt at home and knew their way to wherever they wanted to go.

Anne Lipow (1992) pointed out that in order to make effective use of the electronic library researchers needed an explicit grasp of a number of basic concepts – record structures and fields, Boolean logic and the definitions and functions of catalogues and databases – but despite this call to arms there is little evidence of a movement to provide these concepts. Our own practical experience of the area (White et al., 2004) has led us to the following conclusions -

- The assumption that information skills training was not needed by academic staff was incorrect.

- The networks and mentoring systems through which academics acquired and maintained professional skills were not sufficient to provide the necessary competencies.

- Academics information practices tended towards "area scanning" and moving from known to new references rather than following the keyword searching approach practised by librarians.

- The "principle of least effort" determined that researchers would try to generalise the smallest skill set that would allow them to operate effectively but that this tendency ran in opposition to

the complexity, inconsistency and rapid change characteristic of the electronic information environment.

- The desired skill set would include browsing, searching and scanning skills, use of current awareness tools, the Internet and bibliographic management software and would position electronic information practice within the wider academic context.

- Enhancement and ongoing maintenance of the electronic research knowledge and skills of university research staff are critical if they are to take advantage of the very considerable information sources and tools available to them.

The positive response to the training that we provided through the university's Training and Development Unit has confirmed our view that academic staff did indeed perceive shortcomings in their own skills and understanding. A particular concern has been to introduce participants to the interoperability of the different systems within the environment and to encourage them to use such features as alerts and bibliographic managers. In this way they begin to become "residents" rather than "visitors" and the value they receive from the systems will stimulate the development of further skills. At the same time we are aware of having barely scratched the surface and that while many of the staff have been able to follow the directions we gave them they have not graduated to a robust perception of the wider picture. In these cases the usefulness of their learning will decay over time – is doing so in fact – as changes in the environment render it obsolete. Indeed a number of participants have expressed the need for a "refresher" and some have in fact returned to the module for a second session, having realised that they still had some way to go in exploiting the full potential of the electronic environment.

An optimistic view of the matter would be that many of the obstacles described here are the result of minor and temporary inconsistencies that will diminish over time in the same way that previously frustrating software inconsistencies have been overcome by the almost universal adoption of the Microsoft software suite. This convenient result has, however, been achieved by the domination of the software market by one player, a domination that would be wholly undesirable if it applied to the domain of academic information. Many of the inconsistencies between databases are now of more than ten years standing and, as each new offering or iteration represents a further attempt to reinvent the wheel, we may be moving away from, rather than towards, uniformity. Interoperability and consistency do exist, however, within the offerings of individual providers, particularly the big electronic journal and encyclopaedia offerings of major publishers that come packaged as "digital libraries". The researcher who has entered a digital library finds the direct linkage between the search and document retrieval functions so satisfying that a strong temptation exists not to return to the cold outside world in which searchable databases and content are kept at arm's length. To many researchers with limited skill sets loss of search universality is a price they are willing to pay for convenience, a price they may scarcely be aware of in fact. For the content provider on the other hand there is an incentive to maintain a degree of disuniformity between their own product and that of their competitors that guarantees a "switching cost" to any of their loyal clients wishing to stray into other digital worlds.

How then are we to grapple with these problems? We are aware of having made a step in the right direction but this has served more to make us aware of the dimensions of the issues than to put in place comprehensive solutions. The Technology Acceptance Model (TAM) (Davis, 1989; Thong, Hong, & Tam, 2002) suggests that we need to provide a more thoroughgoing demonstration of the benefits of the full technology coupled with the support and training that will transform our clients from visitors or immigrants into residents of the electronic information domain. Simply hoping that users will pick up the use of these products through lack of alternative strategies will not suffice and will abrogate our responsibility to ensure proper exploitation of institutional resources. The TAM model suggests that the two critical factors in technology acceptance, *perceived ease of use* and *perceived usefulness*, are intimately related to one another – that a perception of usefulness will of itself enhance the perceived ease or use and vice versa. This raises however a chicken and egg issue – how are we to give researchers sufficient awareness of the usefulness of electronic information technology before they have gained sufficient skills to experience the benefits for themselves? The answer may lie in library and computing staff recognising the interdependencies between their fields and working together more

closely in advocating that the academic community takes up full residence in the electronic information domain.

There are a numbers of practical steps that librarians can take to address issues of perceived ease of use and usefulness:

- University academics and researchers need to be identified as a group whose information training needs are as important as those of students.

- We need to recognise and acknowledge the practical difficulties faced by our customers in using the electronic information environment. Unless this is done they feel that the problems they experience originate entirely with their own lack of skill and are consequently discouraged from further exploration.

- Users can best appreciate the value of the electronic information environment by seeing the "big picture" – not only information search skills but bibliographic management tools, electronic document storage, information alerts and so on. As well as training users on individual products librarians need to provide the sort of overview that will make the full benefits of upskilling apparent.

- The inclusion of information skills training within the institution's formal training programme for academic and research staff will facilitate attendance and make the training more attractive to its target audience.

- Librarians rightly place a strong emphasis on content and coverage of electronic products but this has been to the detriment of the usability studies that are common among the computing community. Further research into the usability of electronic information products, within the user's environment, needs to be undertaken by librarians.

- As the purchasers of electronic information products we can take a more proactive role in insisting that these products conform to existing formal or de facto standards. While it may be difficult to base the actual purchase decision on apparently minor questions of functionality we need to assert our rights as customers. In many other areas of technology, consumer pressure has been successful in promoting standardisation and interoperability where vendors have tried to create brand-exclusive domains.

3 CONCLUSIONS

The electronic information revolution has transformed the world of academic research over the past twenty years, probably to the point at which the major part of the money that university libraries spend on published information is going to electronic resources. The scope of research itself has been broadened but this has not been without cost, particularly in human terms, and there appears to have been no considered attempt to support the expenditure on electronic product with a concomitant investment in the human resources needed to reap the full benefits of these changes. New models of training and support are urgently needed if this is to happen.

4 REFERENCES

Adams, A., & Blandford, A. (2002). Digital libraries in academia: Challenges and changes. In E.-P. Lim, S. Foo, C. Khoo, H. Chen, E. Fox, S. Urs & T. Constantino (Eds.), *Digital Libraries : People, Knowledge, and Technology : 5th International Conference on Asian Digital Libraries, ICADL 2002, Singapore, December 11-14, 2002: Proceedings* (pp. 392-403). Berlin: Springer.

Bishop, A. P. (1999). Making digital libraries go: Comparing use across genres. In *Proceedings of the Fourth ACM Conference on Digital Libraries* (pp. 94-103). New York: ACM Press.

Blandford, A., Stelmaszewska, H., & Bryan-Kinns, N. (2001). Use of multiple digital libraries: A case study. In *Proceedings of the 1st ACM/IEEE-CS Joint Conference on Digital Libraries* (pp. 179-188). New York: ACM Press.

Christiansen, L., Stombler, M., & Thaxton, L. (2004). A report on librarian-faculty relations from a sociological perspective. *Journal of Academic Librarianship, 30*(2), 116-121.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340.

Feng, L., Jeusfeld, M. A., & Hoppenbrouwers, J. (2001). Towards knowledge-based digital libraries. *ACM SIGMOD Record, 30*(1), 41-46.

Hannum, W. (2002). Transforming the scholarly process through information technology. *New Directions for Teaching and Learning, 90*, 19-27.

Jankowska, M. A. (2004). Identifying university professors' information needs in the challenging environment of information and communication technologies. *Journal of Academic Librarianship, 30*(1), 51-66.

Lin, H. S. (2002). IT fluency: What is it and why do we need it? In B. L. Hawkins, J. A. Rudy & W. H. Wallace (Eds.), *Technology everywhere: A campus agenda for educating and managing workers in the digital age* (pp. 39-49). San Francisco: Jossey-Bass.

Lipow, A. G. (1992). Outreach to faculty: Why and how. In L. Shirato (Ed.), *Working with faculty in the new electronic library : Papers and session materials presented at the Nineteenth National LOEX Library Instruction Conference held at Eastern Michigan University, 10 to 11 May 1991* (pp. 7-13). Ann Arbor, Michigan: Pierian Press.

Theng, Y. L., Mohd-Nasir, N., & Thimbleby, H. (2000). Purpose and usability of digital libraries. In *Proceedings of the Fifth ACM Conference on Digital Libraries* (pp. 238-239). New York: ACM Press.

Thong, J. Y. L., Hong, W. Y., & Tam, K. Y. (2002). Understanding user acceptance of digital libraries: What are the roles of interface characteristics, organizational context, and individual differences? *International Journal of Human-Computer Studies, 57*(3), 215-242.

White, B., Gendall, R., & Naidoo, K. (2004). No end in sight - information skills for academics and researchers. In P. A. Danaher, C. Macpherson, F. Nouwens & D. Orr (Eds.), *Lifelong learning: Whose responsibility and what is your contribution? Refereed papers from the 3rd International Lifelong Learning Conference, Yeppoon, Central Queensland, Australia* (pp. 366-372). Rockhampton: Central Queensland University Press.

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2005